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PROPELLANT EXPLOSIVE.

No drawing.

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To all whom it may concern:

Be it known that we, ARTHUR S. O'NEIL and RAYMOND ROYAL EVANS, citizens of the United States, residing at Springfield, in the county of Sangamon, State of Illinois, have invented certain new and useful Improvements in Propellant Explosives; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improved propellant explosive, in powder form, designed for use in ammunition of various kinds.

The improved propellant explosive of the present invention is composed of an intimate mixture or blend of nitrocellulose and ordinary black powder, with the nitrocellulose present in preponderating proportion, and the black powder present in sufficient amount, e. g., from 5% to 35% by weight of the mixture, to aid in the combustion of the nitrocellulose, so that the composite product has improved properties, as a propellant explosive, hereinafter more fully set forth.

The invention also includes an improved method or methods of producing the composite propellant explosive in powder form.

The new propellant explosive of the present invention can be made by intimately mixing and blending the nitrocellulose and black powder and granulating the mixture or blend by any suitable method of granulation. The nitrocellulose and the black powder may thus be mixed in the desired proportion, and the mixture tumbled in a tumbling barrel and the granulation formed by adding a small amount of solvent, such as acetone or ethyl acetate, which will cause the powder to roll up into small particles, which are afterwards screened and sized by screens or other means. This method of mixing and granulating is similar to that used in making bulk smokeless powder.

Another advantageous method of production of the new propellant explosive is to colloid the nitrocellulose, for example, by introducing the nitrocellulose into a regular powder mixer, together with the proper amount of solvent, such as ether and alcohol; and to bring about the intermixture of the resulting colloid with an aqueous paste containing the black powder, and made, for ex-

ample, by mixing the black powder dope, as it comes from the wheel mill, into a paste with 50% alcohol and 50% water. The black powder dope, before it is mixed into the paste, should be thoroughly incorporated in a wheel mill in much the same manner as for the manufacture of ordinary black powder. The nitrocellulose colloid and the black powder paste may be mixed, for example, in the manner commonly used for the manufacture of smokeless powder. The mixture may be subjected to granulation by any suitable method. The mixture may thus be pressed, granulated and dried in much the same manner as that employed for making smokeless powder.

The resulting product will contain the nitrocellulose and the black powder blended together in the form of an intimate mixture or blend. The product will be of a composite character, with the nitrocellulose present in preponderating proportion, and with the black powder present in relatively small proportion, that is, from 5 to 35% by weight of the mixture. The black powder may be of the ordinary composition, i. e., made of sulfur, carbon and saltpetre in the usual proportions. Other oxidizing ingredients besides potassium nitrate can, however, be used in the formation of the black powder, such as barium nitrate, sodium nitrate, etc.

The new propellant explosive of the present invention possesses various advantages which distinguish it from black powder alone and from smokeless powder, as well as from mixtures heretofore proposed containing a preponderating proportion of black powder (e. g., around 80%) and a small proportion of nitrocellulose (e. g., around 20%). When a small amount of nitrocellulose is used with a large amount of black powder, the resulting mixture partakes of the nature of black powder, while the nitrocellulose serves to stick the particles of black powder together and to give a cleaner combustion; whereas the new explosive of the present invention presents the advantage, among others, that the black powder serves as an aid to the combustion of the smokeless powder or nitrocellulose in a particularly advantageous manner.

In the case of black powder alone, only about 53% or 54% of permanent gases are

produced when the powder is fired, the remainder of the composition being converted into a liquid or fused state by the high temperature. In the case of smokeless powder alone, over 90% of the material is converted into permanent gases. With the new propellant explosive of the present invention, containing a preponderating proportion of nitrocellulose, and a substantial but relatively smaller proportion of black powder, a large gas volume is obtained from the smokeless powder supplemented by that from the black powder, while the black powder will give a considerable quantity of substances in a liquid or fused state at a high temperature, and these substances will serve to maintain and equalize the temperature of the gases produced by the ignition, thus materially aiding in the work done upon the projectile. In consequence, relatively high velocities can be obtained with relatively low pressures.

The new explosive presents the further advantage that the ignition of the nitrocellulose is considerably accelerated by the presence of the black powder in the small proportions used, so that the black powder serves as an aid to the combustion of the smokeless powder.

When the new propellant explosive is made by compounding nitrocellulose in the form of a solution or colloid, with an aqueous paste of black powder, in the manner above described, the process is advantageously modified by the water employed. When the powder is pressed, the water is forced toward the surface of the grain and acts as a lubricant, making a very free-flowing and smooth colloid. The water has the further advantage of making the mixture difficult to ignite during the mixing and granulating operations, thus increasing the safety of these operations. With smokeless powder as commonly manufactured, if a free flame is applied, the ether and alcohol ignite, and, as the ether and alcohol leave the grain, the nitrocellulose ignites and a very rapid burning is produced. With black powder, a free flame produces a flash. With the composition of the present invention, only the grains affected by the flame will burn; and the remainder of the powder is unaffected by the fire. The water used in the composition has the further advantage of partly precipitating the nitrocellulose, thus making the

powder grain more or less bulky. This is advantageous in that more perfect ignition is produced.

By granulating the powder, i. e., by forcing the mixture through a die and cutting into a uniform and regular granulation, the granulation can be controlled at all times, and a definite and uniform granulation obtained which will adapt the powder to fit the particular kind of ammunition for which it is to be fired. The granulation can be brought about and regulated by forcing through a die, etc., in much the same manner as smokeless powder, for use in small ammunition or in guns of large calibre, etc.

We claim:

1. The method of producing a propellant explosive in powder form containing black powder and nitrocellulose, the nitrocellulose being present in preponderating proportion, which consists in first colloidizing the nitrocellulose, then intermixing this colloid with an aqueous paste containing black powder, forcing the mixture of nitrocellulose colloid and aqueous black powder through a die to form regular granulations and finally cutting the resulting products into granules.

2. The method of producing a propellant explosive which comprises forming an intimate mixture of black powder with nitrocellulose, the latter being present in preponderating proportion, which consists in first forming a nitrocellulose colloid which is then mixed with a black powder paste containing water, forcing the mixture through a die and cutting the resulting product into granules.

3. The method of producing a propellant explosive which comprises forming an intimate mixture of nitrocellulose colloid with a black powder paste containing water and alcohol, forcing the resulting mixture through a die, and cutting the resulting product into granules.

4. The method of producing a propellant explosive which comprises forming an intimate mixture of nitrocellulose colloid with a black powder paste containing substantially 50% water and 50% alcohol, forcing the resulting mixture through a die, and cutting the resulting product into granules.

In testimony whereof we affix our signatures.

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